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Enclosed herewith is a certified copy of European Patent Application No.

00203882.6 <sup>filed</sup> June 11, 2000 in connection with the above-identified application.

Respectfully submitted,

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**SOLVENT BASED COATING COMPOSITION**

The present invention pertains to solvent based coating compositions and their  
5 use in car refinish applications.

DE-A-29 24 632 discloses a solvent based basecoat composition comprising:

- A) a toner composition comprising an effect pigment, an acrylic resin, a polyester, and a cellulose ester,
- 10 B) a toner composition comprising a solid color pigment and an acrylic polyol incompatible with the resins in toner composition A, and
- C) a third component comprising a cellulose ester and an acrylic resin.

EP-A-0 794 237 discloses a coating composition comprising:

- 15 A) a metallic base and a tint base,
- B) a metallic base booster comprising an alkyd resin as a film forming polymeric material,
- C) a reducer being a solvent blend with or without reactive diluents, and
- D) a hardener such as a polyisocyanate.
- 20 Other film forming polymeric materials include acrylics and polyesters.

JP-A-98-46067 discloses a coating composition comprising

- A) a toner composition comprising an acrylic resin, an alkyd resin, a cellulose resin, and a pigment,
- 25 B) a reducer base containing a solvent mixture.

US 4,532,177 discloses a basecoat composition comprising a film-forming resin selected from, among others, a polyester and an acrylic, blended with a cellulose ester material and a pigment.

30

The present invention pertains to a solvent based coating composition comprising

- A) at least one toner base comprising an acrylic polyol, a cellulose resin, a polyester polyol, and a pigment,
- B) at least one connector base comprising at least one resin compatible with the resins mentioned in toner base A), and
- 5 C) at least one reducer base free of binders and pigments.

It has been found that coating composition of the present invention does not have drawbacks such as insufficient hiding, a high sensitivity for cloudiness and a loss of brightness or color. Such properties are often found in basecoat compositions. Furthermore, the coating composition of the present invention provides a very flexible application window. Due to a selection of binders, additives, and/or fillers to be used in the connector base (B), the use and properties of the coating composition of the present invention can be modified. For example an interior coating may be prepared from the coating composition of the present invention with excellent properties such as gloss level and scratch resistance.

Preferably, toner base (A) comprises at least 25 wt.% on solids of resins and connector base (B) comprises at most 75 wt.% on solids of resins. More preferably, toner base (A) comprises 25 to 95 wt.% on solids of resins and connector base (B) comprises at 5 to 75 wt.% on solids of resins. Most preferably, toner base (A) comprises 50 to 90 wt.% on solids of resins and connector base (B) comprises at 10 to 50 wt.% on solids of resins.

25 The compatible resin which is used in the connector base (B) is selected from an acrylic polyol, a cellulose resin, a polyester polyol, a polyurethane polyol, a vinyl resin, a polyisocyanate, and/or mixtures thereof.

Also preferred is that toner base (A) and connector base (B) comprise together the following binders:

- 10 - 40 wt.% on solids of cellulose resin,  
25 - 80 wt.% on solids of acrylic polyol,



15 - 45 wt.% on solids of polyester polyol, and

0 - 20 wt.% on solids of a compatible resin,

the sum of the wt.% indicated for the binders always being 100 wt.%.

- 5 In a preferred embodiment both toner base (A) and connector base (B) comprise the same binders. In a more preferred embodiment thereof, the binders in the toner base (A) and connector base (B) are used in the same ratio. A basecoat composition can thus be prepared with excellent coating properties.
- 10 Alternatively, by using different binders in connector base (B) coating compositions can be prepared having different properties. The presence of a cellulose resin within connector base (B) provides a basecoat composition according to the invention with a fast dry-time. Such a basecoat can then advantageously be used in striping or decoration. Preferably, a mixture of CAB
- 15 381-0.1 and CAB 381-20 is used.

The presence of a polyester polyol in the connector base (B) will result in a more sluggish yet much more flexible basecoat composition for plastic surfaces.

- 20 It is also possible to provide a connector base (B) comprising additives, such as wax, and fillers, such as fumed silica, to provide a low gloss coating composition to be used as an interior coating composition.

- 25 The presence of a polyol in either the toner base (A) and/ or in the connector base (B) provides the possibility to chemically crosslink the coating composition. For example, a polyol can be crosslinked with an isocyanate hardener resulting in a simple 2K system for door jams and inside (under the hood) use. To this effect, the basecoat composition may comprise a crosslinker base (D). Preferably, the crosslinker base (D) comprises an isocyanate hardener.

30

Examples of the resins used in the coating composition of the present invention are explained below.

- The acrylic polyol may be derived from hydroxy-functional acrylic monomers, such as hydroxy ethyl (meth)acrylate, hydroxy propyl (meth)acrylate, hydroxy butyl (meth)acrylate, other acrylic monomers such as (meth)acrylic acid, methyl (meth)acrylate, butyl (meth)acrylate, optionally in combination with a vinyl derivative such as styrene, and the like, or mixtures thereof, wherein the terms (meth)acrylate and (meth)acrylic acid refer to both methacrylate and acrylate, as well as methacrylic acid and acrylic acid, respectively. The polyacrylate is prepared by conventional methods, for instance, by the slow addition of appropriate monomers to a solution of an appropriate polymerization initiator, such as an azo or peroxy initiator. Preferably, the acrylic polyol is prepared from hydroxy propyl methacrylate, methyl methacrylate, butyl methacrylate, and methacrylic acid.
- 15 The acrylic polyol must have a hydroxy value of between 25 and 300 mg KOH/g solid resin, preferably between 45 and 250 mg KOH/g solid resin. The number average molecular weight of the polymer is lower than 15,000, as measured by gel permeation chromatography using polystyrene or polypropylene glycol as a standard, preferably less than 10,000. The degree of molecular dispersion, i.e.,
- 20 the ratio of Mw to Mn, preferably is in the range of 1.1 to 5, the range from 1.5 to 4 being particularly preferred. The acid value of the polymer is between 0 and 50 mg KOH/g solid resin. The glass transition temperature is above 10°C, preferably between 25 and 75°C.
- 25 Cellulose resins are cellulose compounds esterified by at least one monocarboxylic acid. Examples of suitable monocarboxylic acids include monocarboxylic acids containing 2 to 5 carbon atoms, such as acetic acid, propionic acid and butyric acid. Use may, of course, also be made of cellulose resins having different carboxylic acid groups or physical mixtures of different
- 30 cellulose esters. The cellulose resins generally to be used in actual practice as a rule also contain a small amount of hydroxyl, for instance a few percent by weight. It is preferred that use should be made of a cellulose acetobutyrate.

Commercial products include CAB 381-01, CAB 381-20, and CAB 553-0.4 from Eastman Kodak.

- The polyester polyol is preferably a branched polyester polyol. More preferably, the branched polyester polyol is the reaction product of
- (a) at least one cyclo aliphatic and/ or aromatic polycarboxylic acid or derivatives thereof,
  - (b) at least one  $C_{3-12}$  triol, and
  - (c) optionally, one or more monoalcohol, polyol, aromatic polycarboxylic acid, acyclic aliphatic polycarboxylic acid, monocarboxylic acid or glycidyl ester of monocarboxylic acid.

Particularly suitable polyester polyols for film forming binders and coating compositions of the present invention have a molecular weight ( $M_n$ ) ranging from 500 to 3000, preferably from 750 to 2500, as determined by gel permeation chromatography using polystyrene or polypropylene glycol as a standard. The degree of molecular dispersion, i.e., the ratio of  $M_w$  to  $M_n$ , preferably is in the range of 1.1 to 5, ranges from 1.5 to 3 being preferred particularly. The acid value of the polyester polyol is preferably below 30, most preferably below 20. Suitable hydroxyl values are in the range of 75 to 300 mg KOH/g solid resin, preferably 100 to 250 mg KOH/g solid resin. The glass transition temperature is below  $25^\circ\text{C}$ , preferably between 15 and  $-50^\circ\text{C}$ .

The polyester polyols are prepared using conventional techniques. The reactants and the molar ratios of the reactants are chosen in such a way that they provide a reaction product having a number of residual hydroxyl groups. Typically, the polyester polyols are formed by charging the carboxylic and hydroxylic components in a suitable polymerisation vessel and heating the reaction mixture under an inert atmosphere to 150 to  $260^\circ\text{C}$  with removal of condensation water. The reaction may be carried out in the presence of an esterification catalyst and is considered complete when the desired hydroxyl and acid values are obtained.

The polyester polyols preferably possess a branched structure. Branched polyesters are conventionally obtained through condensation of polycarboxylic acids or reactive derivatives thereof, such as the corresponding anhydrides or lower alkyl esters, with polyalcohols, when at least one of the reactants has a functionality of at least 3.

The polyester polyol should contain a sufficiently high amount of cyclic moieties to provide coatings of considerable hardness. Preferably, these cyclic moieties belong to the polycarboxylic components and are provided by cyclo aliphatic or/and aromatic polycarboxylic acids or reactive derivatives thereof. To impart sufficient hardness, the molar ratio of the acyclic aliphatic polycarboxylic acids to the total of the polycarboxylic acids is preferably less than 0.3:1, more preferably less than 0.1:1. Further, the molar ratio of the cyclo aliphatic polycarboxylic acids to the total of the polycarboxylic acids is typically in the range from 0.3:1 to 1:1, more preferably from 0.45:1 to 1:1

Examples of suitable cyclo aliphatic polycarboxylic acids or reactive derivatives thereof are tetrahydrophthalic acid, tetrahydrophthalic anhydride, hexahydrophthalic acid, hexahydrophthalic anhydride, methyl hexahydrophthalic acid, methyl hexahydrophthalic anhydride, dimethyl cyclohexane dicarboxylate, 1,4-cyclohexane dicarboxylic acid, 1,3-cyclohexane dicarboxylic acid, and mixtures thereof. Hexahydrophthalic anhydride and 1,4-cyclohexane dicarboxylic acid are preferred.

Examples of aromatic polycarboxylic acids and reactive derivatives thereof are phthalic acid, phthalic anhydride, isophthalic acid, terephthalic acid, 5-tert. butyl isophthalic acid, trimellitic anhydride, and mixtures thereof.

Examples of acyclic aliphatic polycarboxylic acids or reactive intermediates thereof are maleic acid, maleic anhydride, fumaric acid, succinic acid, succinic anhydride, dodecenyl succinic anhydride, dimethyl succinate, glutaric acid,

adipic acid, dimethyl adipate, azelaic acid, and mixtures thereof. Adipic acid is preferred. Optionally, up to 20 wt.% of the acyclic aliphatic polycarboxylic acid is used in the preparation of the polyester polyol.

5 Up to 40 wt.% monocarboxylic acids, based on all monomers used for the preparation of the polyester polyol, preferably C<sub>4</sub>-C<sub>18</sub> monocarboxylic acids, are also preferably among the reactants used to produce the polyester polyol. More preferably, 5 to 30 wt.% of monocarboxylic acids are used.

10 Examples of the C<sub>4</sub>-C<sub>18</sub> monocarboxylic acids include pivalic acid, hexanoic acid, heptanoic acid, octanoic acid, nonanoic acid, 2-ethyl hexanoic acid, isononanoic acid, decanoic acid, lauric acid, myristic acid, palmitic acid, isostearic acid, stearic acid, hydroxystearic acid, benzoic acid, 4-tert. butyl benzoic acid, and mixtures thereof.

15

The one or more polyalcohol reactant(s) used to form the polyester can be cyclic or acyclic or a mixture thereof. Triols are preferred polyalcohols. They can be used as the sole alcohol component but suitable polyesters can also be prepared from mixtures of triols or from mixtures of one or more triol with other  
20 OH-containing compositions, such as monoalcohols, diols, tetraols, and mixtures thereof. Preferably, from 5 to 40 wt.% of triol is used in the preparation of the polyester polyol.

Suitable triols are C<sub>3-12</sub> triols. Examples of triols are trimethylol propane, trimethylol ethane, glycerol, and 1,2,6-hexanetriol. Trimethylol propane and  
25 trimethylol ethane are preferred.

Suitable diols are C<sub>2</sub>-C<sub>15</sub> diols. Examples of diols are ethylene glycol, 1,2-propylene glycol, 1,3-propylene glycol, 2-methylpropane-1,3-diol, neopentyl glycol, 2-butyl-2-ethyl-1,3-propane diol, cyclohexane-1,4-dimethylol, the  
30 monoester of neopentyl glycol and hydroxypivalic acid, hydrogenated Bisphenol A, 1,5-pentanediol, 3-methylpentanediol, 1,6-hexanediol, 2,2,4-trimethyl

p ntane-1,3-diol, and dimethylol propionic acid. Neopentyl glycol, 1,6-hexanediol, 2-butyl-2-ethyl-1,3-propane diol, cyclohexan dimethylol, dim thylol propionic acid, and the monoester of neopentyl glycol and hydroxypivalic acid are preferred. Up to 50 wt.% of the diol may be used in the preparation of the polyester polyol.

Suitable tetraols are  $C_{4-12}$  tetraols. Examples of tetraols are pentaerythritol and di-trimethylolpropane. Up to 20 wt.% of the tetraol may be used in the preparation of the polyester polyol.

Suitable monoalcohols are, for example,  $C_6-C_{18}$  monoalcohols. Specific examples are cyclohexanol, 2-ethylhexanol, stearyl alcohol, and 4-tert. butyl cyclohexanol. Up to 20 wt.% of the monoalcohol may be used in the preparation of the polyester polyol.

To form the polyester, a combination of triol and monocarboxylic acid can also be used in the form of preformed glycidyl esters of  $C_5-C_{15}$  monocarboxylic acids, for example the glycidyl esters of branched  $C_9-C_{11}$  monocarboxylic acids, commercially available as Cardura E10 from Shell.

Examples of the polyurethane polyol include the reaction product of a 2- to 5-functional polyisocyanate and a polyalcohol having at least 2 hydroxyl groups, or the reaction product of a polyamine and a cyclic carbonate. The reactants and the molar ratios of the reactants are chosen in such a way that they provide a reaction product having a number of residual hydroxyl groups. The cyclic moieties in the polyurethane polyol can be aromatic, cycloaliphatic, heterocyclic or mixtures thereof. The cyclic moieties may be present either in the polyalcohol reactant(s) and/ or the isocyanate reactant(s) of the polyurethane.

The 2- to 5-functional polyisocyanate is preferably isophorone diisocyanate, tetramethylxylene diisocyanate, m thylene bis(4-cyclohexyl isocyanat ), norbornane diisocyanate, isocyanurat trimer of isophorone diisocyanate, the



reaction product of 3 moles of m-t trimethylxylene diisocyanate with 1 mole of trimethylol propane, the reaction product of 3 moles of toluene diisocyanate with 1 mole of trimethylol propane, toluene diisocyanate, the isocyanurate of hexamethylene diisocyanate, the uretdion of isophorone diisocyanate, the uretdion of hexamethylene diisocyanate, the allophanate of hexamethylene diisocyanate, and mixtures thereof. Particularly preferred are the isocyanurate trimer of isophorone diisocyanate, methylene bis(4-cyclohexyl isocyanate), and the reaction product of 3 moles of m-tetramethylxylene diisocyanate with 1 mole of trimethylol propane. Preferably, from 20 to 80 wt.% of polyisocyanate is used in the preparation of the polyurethane polyol, more preferably from 30 to 70 wt.%.

The polyalcohol is preferably selected from the group of diols and triols.

The diol preferably is selected from the group of ethylene glycol, 1,2-propane diol, 1,3-propane diol, 1,3-butane diol, 2-methyl-1,3-propane diol, 2-ethyl-2-butyl-1,3-propane diol, 2,2,4-trimethyl-1,3-pentane diol, 2-ethyl-1,3-hexane diol, neopentyl glycol, cyclohexane dimethanol, hydrogenated Bisphenol A and mixtures thereof. Also preferred diols are low molecular ( $M_n < 500$ ) condensates of dicarboxylic acids and monomeric diols, for example, prepared from 1 mole of hexahydrophthalic anhydride and 2 moles of 2-butyl-2-ethyl-1,3-propanediol. Up to 70 wt.% of diol is used, preferably from 20 to 65 wt.%.

Triols preferred for use as the polyalcohol are glycerol, trimethylol propane, trimethylol ethane or mixtures thereof. Up to 25 wt.% of triols may be used, preferably 1 to 20 wt.%

Optional up to 30 wt.% of further reactant(s) for preparation of the polyurethane polyol may be used, such as  $C_1$ - $C_{18}$  monoalcohols whereby the molar ratio of monoalcohol to diol and/or triol component is less than 2,  $C_2$ - $C_{25}$  primary or secondary monoamine compounds, optionally substituted with a hydroxyl group, whereby the molar ratio of the monoamine to diol and/or triol is lower

than 2, and C<sub>2</sub>-C<sub>25</sub> diamine compounds comprising primary and/or secondary amine groups, whereby the molar ratio of the diamine to diol and/or triol is lower than 2.

- 5 Suitable monoalcohols are, for example, methanol, ethanol, butanol, 2-ethyl hexanol, cyclohexanol, benzyl alcohol, stearyl alcohol and mixtures thereof.

Suitable monoamines are, for example, butyl amine, dibutyl amine, isopropanol amine, N-methyl ethanol amine, benzyl amine, and mixtures thereof.

10

Suitable diamines are, for example, isophorone diamine, cyclohexane diamine, propylene diamine, piperazine, aminoethyl piperazine, and mixtures thereof.

- 15 For the preparation of the polyurethane polyol the ratio of hydroxyl groups and, optionally amine groups, to isocyanate groups ranges from 1.2 to 3.

- It is preferred that the number average molecular weight (M<sub>n</sub>) of the polyurethane polyol is less than 5000, most preferred are polyurethane polyols having a M<sub>n</sub> of less than 3000, as determined by gel permeation chromatography using polystyrene or polypropylene glycol as a standard. The degree of molecular dispersion, i.e., the ratio of M<sub>w</sub> to M<sub>n</sub>, preferably is in the range of 1.1 to 5, ranges from 1.1 to 3 being preferred particularly. Preferably, the polyurethane polyols have a hydroxyl number below 350 mg KOH/g solid resin, more preferably in the range from 50 to 350 mg KOH/g solid resin, even more preferably in the range of 50 to 250 mg KOH/g solid resin.
- 20
- 25

- The synthesis of the polyurethane polyols of the invention preferably is carried out at a temperature of 125 °C or less, most preferably in the range from 15 °C to 100 °C. The components may optionally be reacted in the presence a polyurethane catalyst, for example, organic tin compound, such as, dibutyltin dilaurate or tertiary amine, such as, triethylenediamine.
- 30



Examples of vinyl resins include copolymers of vinyl chloride and vinyl acetate. Preferably, the copolymer comprises 5 to 50% vinyl acetate. These copolymers are prepared using solution- or suspension polymerisation techniques. Optionally, the vinyl resins may have hydroxy or acid groups. For example, in the copolymers of vinyl chloride and vinyl acetate hydroxy or acid groups can be incorporated by partial hydrolysis of the vinyl acetate or copolymerisation with maleic anhydride or hydroxy-functional (meth)acrylic monomers respectively, as known in the industry. Commercial vinyl resins include Vinylite (ex Union Carbide), Vilit (ex Hüls), Vinnol (ex Wacker), and Solvic (ex Solvay). Preferably, vinyl resins from Union Carbide are used in the coating composition of the present invention. An example of such a resin include UCAR® solution vinyl VYNC-P prepared from vinyl chloride, vinyl acetate, and hydroxy alkyl acrylate.

The vinyl resin may have a hydroxy value of between 10 and 100 mg KOH/g solid resin, preferably between 20 and 50 mg KOH/g solid resin. The number average molecular weight of the polymer is lower than 30,000, as measured by gel permeation chromatography using polystyrene or polypropylene glycol as a standard, preferably less than 25,000. The degree of molecular dispersion, i.e., the ratio of Mw to Mn, preferably is in the range of 1.1 to 5. The glass transition temperature is above 10°C, preferably between 25 and 75°C.

Examples of polyisocyanates include those mentioned above in the preparation of a polyurethane polyol. Preferred polyisocyanates include the isocyanurate and biuret of hexane diisocyanate.

25

Applicable pigments may have an acid, a neutral or a basic character. Optionally, the pigments may be pre-treated to modify the properties. Examples of suitable pigments include metallic pigments such as aluminium and stainless steel; nacreous pigments, such as mica coated with a metal oxide such as iron oxide and/or titanium dioxide; inorganic pigments, such as titanium dioxide, iron oxide, carbon black, silica, kaolin, talc, barium sulphate, lead silicate, strontium

chromate, and chromium oxide; and organic pigments, such as phthalocyanine pigments.

5 The solids content of the coating composition ranges from 5-50 wt.%, preferably from 10-40 wt.%.

10 The coating composition according to the invention may be applied to a substrate in any desirable manner, such as by roller coating, spraying, brushing, sprinkling, flow coating, dipping, electrostatic spraying, or electrophoresis, preferably by spraying.

Suitable substrates may be made of wood, metal, and synthetic material. Curing may be carried out at ambient temperature or, optionally, at elevated temperature to reduce the curing time. Optionally, the coating composition may  
15 be baked at higher temperatures in the range of, for instance, 80 to 160 °C, in a baking oven over a period of 10 to 60 minutes.

The compositions are particularly suitable in the preparation of coated metal substrates, such as in the refinish industry, in particular the body shop, to repair  
20 automobiles and transportation vehicles and in finishing large transportation vehicles such as trains, trucks, buses, and aeroplanes. The compositions of the present invention may also be used in the first finishing of automobiles.

The coating composition according to the present invention can be used as a  
25 base coat in a so-called base coat/clear coat system. The clear coat used in the base coat/clear coat system may for instance be a clear baking lacquer of a conventional polyacrylate/melamine composition. The clear coat may also be a two-component polyester or polyacrylate/polyisocyanate composition. The clear coat may be applied wet-on-wet on the base coat. Optionally, the base coat  
30 may be partially cured prior to the application of the clear coat. Also, the base coat may be fully cured prior to the application of the clear coat.

Alternatively, the coating composition according to the present invention can be used as an interior coating. In this particular embodiment, the coating composition can be applied over existing and new interior automotive parts. The substrates include ABS, RIM, polycarbonate, and polyolefin type plastic parts. It is not required to coat the interior coating with a clearcoat.

The invention will be further described in the following examples, which must not be construed as limiting the scope of the present invention.

## Example

Unless otherwise stated, the properties of the coating compositions and the resulting films are measured as follows.

5

The viscosity is measured in a DIN flow cup number 4 in accordance with DIN 53221-1987. The viscosity is given in seconds.

Visual assessment was made of mottling, Bénard cells and EHO (Enamel Hold out) on a scale of 1 to 10 (1= very bad, 10 = excellent).

In a freshly applied, drying coating, pigment particles may be carried selectively towards the surface by drying currents. If drying currents are uneven the dry coating will show floating. In metallics, floating effects may disorient anisotropic aluminium flake pigments. For the resulting visual effect, which may be quite severe when compared with normal floating effects, the term mottling is used.

If drying currents are uneven the dry coating can also become organized in Bénard cells. Except that the overall color of the surface is different from the bulk color, Bénard cells patterns, or other irregular drying effects, will be visible as local color difference.

The Enamel Hold Out (EHO) was determined as the total visual appearance. Each sample is rated for visual appearance on a scale of 1 to 10 (1= very bad appearance, 10 = excellent appearance) by a panel of at least 3 people. The determination takes into account gloss, wrinkling, flow and image clarity/distinctness of image. The average number will give the EHO.

Intercoat adhesion is the adhesion between the basecoat and the clearcoat. The adhesion was tested using the so called pull-off test, in which a cross-cut at 45° is made with an Olfa cutter, after which a standard type adhesion tape is stuck on the paint and gently pulled off again. The values 1 – 10 represent a

scale for evaluation of the adhesion ranging from very poor adhesion (1) to excellent adhesion (10).

5 Adhesion was measured in accordance with the standard ISO 2409 (1992). A rectangular lattice pattern, reaching down to the substrate, is cut into the coating to be tested. After cutting, detached particles are removed by brushing or by pulling-off with adhesion tape. The area of detachment of the coating is scored on a 0 - 10 visual scale.

10 Long wave and short wave readings were made using a wave scan apparatus (Byk).

The gloss is measured in accordance with ISO 2813:1994 (angle 60°). The gloss is expressed in GU.

15

Flexibility was measured in accordance with GM 9503 P.

20 The chemical resistance of the coating was determined by the number of double rubs (1 double rub is 1 to-and-fro movement), needed to rub the coating through to the substrate. The number of double rubs are recorded. If the number of double rubs increases above 100, it is recorded as 100+.

Accelerated weathering was carried out with a Xenon-Arc Weatherometer in accordance with ISO 11341 (1994).

25

In the examples the following compounds are used.

30 Hydroxy group-containing polyacrylate A with the following monomer composition: 14.6 wt.% hydroxy propyl methacrylate, 37 wt.% methyl methacrylate, 47 wt.% butyl methacrylate, and 1.4 wt.% methacrylic acid.

Mw = 15,000; Mn = 5,000 (GPC with polystyrene as standard); hydroxy value = 57 mg KOH/g solid resin, acid value = 10 mg KOH/g solid resin, Tg = 40°C, and solids content = 51 wt.% in butanol/xylene.

- 5 Hydroxy group-containing polyester B with the following monomer composition:  
10 wt.% 3,5,5-trimethyl hexanoic acid, 49 wt.% hexahydrophthalic anhydride, 22  
wt.% neopentyl glycol, and 19 wt.% trimethylol propane. Mn = 1,700 (GPC with  
polystyrene as standard); hydroxy value = 105 mg KOH/g solid resin, acid  
value = 10 mg KOH/g solid resin, Tg = 9°C, and solids content = 75 wt.% in  
10 butyl acetate/xylene.

- Hydroxy group-containing polyester C with the following monomer composition:  
9 wt.% trimethylol propane, 6 wt.% phthalic anhydride, 12 wt.% adipic acid, 32  
wt.% isophthalic anhydride, and 40 wt.% 1,6-hexane diol. Mn = 1,000 (GPC  
15 with polystyrene as standard); hydroxy value = 150 mg KOH/g solid resin, acid  
value = 1,5 mg KOH/g solid resin, Tg = -25°C, and solids content = 80 wt.% in  
butyl acetate/xylene.

- Hydroxy group-containing polyester D with the following monomer composition:  
20 5 wt.% trimethylol propane, 22.9 wt.% 1,4-cyclohexyl dicarboxylic acid, 29.3  
wt.% adipic acid, and 42.8 wt.% 1,6-hexane diol. Mn = 1,411 (GPC with  
polystyrene as standard); hydroxy value = 110 mg KOH/g solid resin, acid  
value = 7.2 mg KOH/g solid resin, and solids content = 80 wt.% in butyl acetate.

- 25 The CAB solution consists of 20 parts CAB 381-01 and 5 parts CAB 381-20 ex  
Eastman Kodak.

UCAR® solution vinyl resin VYNC-P ex Union Carbide, 40% in isopropyl  
acetate.

Desmodur® N75, the biuret of hexane diisocyanate, ex Bayer.

- 30 Syloid 169, a fumed silica ex WR Grace.

MPP-635F a wax ex Micro Powders Inc.

Fascat 4202 is a 10% DBTL solution in xylene, ex. Air Products.

Irgazin DPP Red BO is a bright red pigment, ex. Ciba-Geigy.

#### Example 1 and comparative example A

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Two blue metallic basecoat compositions were prepared. The ratio of blue pigment, Heliogen Blue L7101 F, to metallic pigment, Sparkle Silver E5000AR, was 0.3. The pigment/ binder ratio was 0.27. The following binder combinations (wt.% on solid resin) were tested.

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#### Binder composition of toner base A

	A	1
CAB 381-0.1	19.6	14.0
CAB 381-20	8.4	6.0
Polyol A	52.0	36.0
Polyol B	-----	24.0

#### Binder composition of connector base B

	A	1
CAB 381-0.1	4.9	3.5
CAB 381-20	2.1	1.5
Polyol A	13.0	9.0
Polyol B	-----	6.0

- 15 Toner and connector bases A and B were mixed 1:1. Then the basecoat compositions were set to a 18" DinC4 viscosity by adding the Reducer base C comprising conventional solvents.

- 20 Two panels pretreated with Autocryl Filler 3110 ex Akzo Nobel Coatings (wet on wet version) were sanded and sprayed with the above-mentioned basecoats. A clearcoat was sprayed wet-on-wet on the basecoats prepared from Autoclear MS 2000; Hardener MS 30; 1.2.3 Slow ex Akzo Nobel Coatings in a ratio of 100:50:10. The coated panels were dried for 24 hours at ambient temperature and then aged overnight at 60°C. The resulting coating properties are listed below.
- 25



	M tling	Bénard cells	EHO	Intercoat adh sion	Long wave	Short wav
1	10	8	8	10	6.0	22.3
A	9	7	6	7	3.6	16.6

As can be seen from the results above, a basecoat composition requires a toner base A comprising an acrylic polyol, a cellulose resin, and a polyester polyol.

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#### Examples 2-4 and comparative example B

#### Toner base A

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	2	3	4
Component	Metallic	Pearl	Solid
Aluminium paste (65%)	11	-	-
Pearl	-	7	-
Irgazin DPP Red BTR	-	-	8.2
CAB solution (21%)	25.7	26.4	19.7
Polyol A (51%)	18.5	19.0	14.6
Polyol B (75%)	4.2	4.3	4.0
Polyol C (80%)	4.0	4.1	3.8
Conventional additives/ solvents	36.6	39.2	49.7

#### Connector base B

Component	
CAB solution (21%)	22.9
Polyol A (51%)	16.4
Polyol B (75%)	3.8
Polyol C (80%)	3.6
Conventional additives / solvents	53.3

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The basecoat composition was prepared by mixing Toner base A and Connector base B in a weight ratio of 77: 23. Subsequently, the mixture of A and B was mixed with Reducer base C containing conventional solvents in a volume ratio of 2:1.

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The basecoat compositions were sprayed on car door panels, pretreated with Autocryl Filler 3110 ex Akzo Nobel Coatings and a clearcoat was sprayed wet-on-wet on the basecoats prepared from Autoclear MS 2000: Hardener MS 30: 1.2.3 Slow ex Akzo Nobel Coatings in a ratio of 100:50:10. The coated panels were dried for 30 minutes at 60°C. For comparison, Example 2 was repeated except that a commercial solvent based basecoat was used Autobase ex Akzo Nobel Coatings in a similar metallic color (Comparative Example B). The results of the evaluation of the coatings are listed below. All properties score on a 0 - 10 visual scale.

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Example	Hiding	Sprayability	Smoothness	Gloss	Cloudiness	Color
B	7	8	7	7	7	5
2	9	8	8	8	8	7
3	9	8	8	8	8	7
4	9	8	8	8	----	7

20

As can be seen from the results above, the coating composition of the present invention provides a basecoat with excellent properties such as improved hiding and smoothness and metallic appearance control for metallic and pearl coatings (Examples 2 and 3).

**Examples 5-9****White toner base A**

Component	
Titanium dioxide	23.2
CAB solution (21%)	21.2
Polyol A (51%)	15.5
Polyol B (75%)	4.3
Polyol C (80%)	4.1
Conventional additives/ solvents	31.7

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**Connector bases B**

Component	Matte	Gloss
UCAR (40%)	8.4	5.1
Desmodur N75	3.8	4.4
Polyester polyol D (80%)	16.0	20.5
Wax	10.9	4.4
Fumed silica	7.8	3.1
Conventional additives / solvents	55.1	62.5

- 10 An interior coating composition was prepared by mixing Toner base A and Connector base B in a weight ratio of 66: 33. Subsequently, the mixture of A and B was mixed with Reducer base C containing conventional solvents in a volume ratio of 2:1. For intermediate gloss levels the converters B were intermixed in weight ratios 75:25, 50:50 and 25:75.

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Two plastic panels (ABS) were sprayed with the above-mentioned interior coating compositions. The coated panels were dried for 24 hours at ambient temperature. Properties of the interior coatings are listed below.

Example	5	6	7	8	9
	<b>Gloss White</b>	<b>75:25</b>	<b>50:50</b>	<b>25:75</b>	<b>Matte White</b>
<b>Gloss</b>	20	16	12	8	3
<b>Adhesion</b>	10	n.d.	n.d.	n.d.	10
<b>Flexibility</b>					
25 mm mandrel	9,5	n.d.	n.d.	n.d.	9
50 mm mandrel	10	n.d.	n.d.	n.d.	10
<b>Chemical Resistance Properties (Double Rubs)</b>					
Armor-All	100+	n.d.	n.d.	n.d.	100+
SPF45 Sun Block	100+ *	n.d.	n.d.	n.d.	100+ *
Windex	100+	n.d.	n.d.	n.d.	100+
10% Soap Solution	100+	n.d.	n.d.	n.d.	100+
50% Isopropanol/water	100+	n.d.	n.d.	n.d.	100+
<b>Accelerated Weathering (Xenon-Arc Weatherometer)</b>					
<b>Gloss Change</b>					
500 hours	-0,2	n.d.	n.d.	n.d.	-1,0
1000 hours	-0,7	n.d.	n.d.	n.d.	-0,5
<b>Color Change (delta E)</b>					
500 hours	0,45	n.d.	n.d.	n.d.	0,20
1000 hours	0,35	n.d.	n.d.	n.d.	0,20
<b>Chalking</b>					
500 hours	9	n.d.	n.d.	n.d.	10
1000 hours	8	n.d.	n.d.	n.d.	9

\* indicates that a small amount of coating was transferred to the cloth used for rubbing


As can be seen from the results the coating composition of the present invention provides a very flexible application window due to the compatibility of the resins used. The properties of the resulting coatings are excellent.

#### Examples 10-14

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Examples 5 to 9 were repeated except that in addition to Toner, Connector and Reducer bases A, B, and C, a crosslinker base D was added in an amount of 10 wt.% on the total composition of A, B, and C. The crosslinker base comprises 65 wt.% of the isocyanurate of hexane diisocyanate. Properties of the interior coatings are listed below.

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Example		10	11	12	13	14
Gloss		Gloss White	75:25	50:50	25:75	Matte White
		22	19	14	11	5

As can be seen from the results the use of the crosslinker base does not have a negative influence on the gloss of the resulting coating. Furthermore, the coatings have excellent properties such as resistance to harsh chemicals and solvents.

**Claims**

1. Solvent based coating composition comprising
  - 5 A) at least one toner base comprising an acrylic polyol, a cellulose resin, a polyester polyol, and a pigment,
  - B) at least one connector base comprising at least one resin compatible with the resins mentioned in toner base A), and
  - C) at least one reducer base free of binders and pigments.
- 10 2. Coating composition according to claim 1 characterized in that the resin in the connector base (B) is selected from an acrylic polyol, a cellulose resin, a polyester polyol, a polyurethane polyol, a vinyl resin, a polyisocyanate, and/or mixtures thereof.
- 15 3. Coating composition according to any of the preceding claims characterized in that toner base (A) comprises at least 25 wt.% on solids of resins and connector base (B) comprises at most 75 wt.% on solids of resins.
- 20 4. Coating composition according to any of the preceding claims characterized in that toner base (A) and connector base (B) comprise together the following binders:
  - 10 - 40 wt.% on solids of cellulose resin,
  - 25 - 60 wt.% on solids of acrylic polyol,
  - 25 15 - 45 wt.% on solids of polyester polyol, and
  - 0 - 20 wt.% on solids of a compatible resin,the sum of the wt.% indicated for the binders always being 100 wt.%.
- 30 5. Coating composition according to any of the preceding claims, characterized in that the connector base (B) comprises the same binders as toner base (A).

6. Coating composition according to any one of the preceding claims characterized in that the coating composition comprises additionally a crosslinker base (D).
- 5 7. Coating composition according to claim 6, characterized in that the crosslinker base (D) comprises an isocyanate hardener.
8. Method of refinishing a car using the coating composition according to any one of the preceding claims as a basecoat composition.
- 10 9. Method of refinishing a car using the coating composition according to any one of the preceding claims as an interior coating composition.

**ABSTRACT**

The present invention pertains to a solvent based coating composition comprising

- 5 A) at least one toner base comprising an acrylic polyol, a cellulose resin, a polyester polyol, and a pigment,
- B) at least one connector base comprising at least one resin compatible with the resins mentioned in toner base A), and
- 10 C) at least one reducer base free of binders and pigments.

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It has been found that coating composition of the present invention does not have drawbacks such as insufficient hiding, a high sensitivity for cloudiness and a loss of brightness or color. Such properties are often found in basecoat compositions. Furthermore, the coating composition of the present invention

15 provides a very flexible application window. Due to a selection of binders, additives, and/or fillers to be used in the connector base (B), the use and properties of the coating composition of the present invention can be modified. For example an interior coating may be prepared from the coating composition of the present invention with excellent properties such as gloss level and

20 scratch resistance.

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